

TITLE OF THE INVENTION

## IMAGE FORMING APPARATUS

5

BACKGROUND OF THE INVENTION

## Field of the Invention

The present invention relates to an image forming apparatus that has a tab-inserting function of  
10 delivering a bundle of recording sheets with tab sheets inserted therein.

## Description of the Related Art

Conventionally, image forming apparatuses, such as  
15 copying machines and printers, are provided with a plurality of feed trays, and are capable of forming images on sheets having different sizes and outputting the same. Further, the feed trays include a front-loading tray which is disposed in the body of the image  
20 forming apparatus and pulled out toward the user to set sheets therein, a deck which is disposed outside the body of the apparatus and capable of containing a large number of sheets, and a multi tray which is capable of having irregularly-sized sheets set therein.

25 Further, a sheet fed from the front-loading tray is conveyed via a U-shaped conveying path to an image transfer position, and therefore an image is

transferred onto the lower surface of the sheet. On the other hand, a sheet fed from the deck or the multi tray is linearly supplied to the image transfer position, and therefore an image is transferred onto  
5 the upper surface of the sheet. That is, whether an image is transferred onto the upper surface of a sheet or the lower surface of a sheet depends on a path via which the sheet is fed.

Further, these feed trays can have stacked thereon  
10 not only plain paper, but also various types of materials, such as thick paper, OHP sheets, glossy paper, and envelopes. Tab sheets are among them. The tab sheets are formed with tabs for division of sheets, and a bundle of table sheets is comprised of a  
15 plurality of tab sheets arranged such that the respective locations of tabs on the tab sheets are sequentially shifted from an uppermost location to a lowermost location. For example, there are three-tab sheets formed by three sheets each formed with a tab,  
20 and five-tab sheets formed by five sheets each formed with a tab. One set of three-tab sheets is comprised of three tab sheets, and one set of five-tab sheets is comprised of five tab sheets. In general, the tab sheets forming one set are sequentially named a first  
25 page, a second page, a third page, ..., starting with a sheet formed with a tab at the uppermost location.

On the other hand, the image forming apparatus is

also provided with a plurality of discharge trays for discharging sheets. Particularly, for a multifunction machine, which has a copying function, a printing function, a facsimile function, and so forth,  
5 integrated in a single unit, it is an essential requirement to have a plurality of discharge trays for sorting sheets discharged by these functions.

The discharge trays are largely classified into a face-up tray onto which sheets are discharged with an  
10 image-transferred surface thereof facing upward, and a face-down tray onto which sheets are discharged with an image-transferred surface thereof facing downward.

Trays often used in conventional copying machines, which allow sheets to be linearly discharged out in a  
15 conveying direction, are examples of the face-up tray, and trays often used in conventional printers, which are disposed at the top of the printers and allows sheets to be discharged, are examples of the face-down tray.

20 When a bundle of sheets are discharged onto the face-up tray or the face-down tray, since a new sheet is stacked on sheets already stacked on the discharge tray, the order of output of pages is different between the face-up tray and the face-down tray. Normally,  
25 onto the face-up tray, sheets are discharged starting with the last page first, whereas onto the face-down tray, sheets are discharged starting with the first

page first.

To this end, depending on the type of discharge trays onto which sheets are to be discharged, control is provided such that the order of pages to be output  
5 is switched over. Further, some image forming apparatuses are capable of inverting sheets printed with images during conveyance thereof inside the machine, to use a face-up tray as a face-down tray.

Further, as for tab sheets, even when they are  
10 discharged onto the face-up tray, they are discharged starting with the first page of a tab sheet bundle, so that the order of tabs in the tab sheet bundle discharged onto the face-up tray is reversed. To eliminate this inconvenience, some commercially  
15 available tab sheets are provided, which are already reversed in the order of pages of a tab sheet bundle. A bundle of tab sheets stacked in a normal page order is called a normal tab sheet bundle. The first page of the normal tab sheet bundle has a tab formed at an  
20 uppermost location of a right-hand side thereof, and the following pages each have a tab formed at a lower location than the location of a tab on the immediately preceding page. A bundle of tab sheets stacked in a reverse page order is called a reverse tab sheet bundle.  
25 The last page of the reverse tab sheet bundle has a tab formed at an uppermost location of a right-hand side thereof, and the preceding pages each have a tab formed

at a lower location than the location of a tab on the immediately following page.

The conventional image forming apparatuses are constructed as described above, and therefore, to print on tab sheets, if they are to be discharged onto the face-up tray, it is only necessary to use a reverse tab sheet bundle, whereas if they are to be discharged onto the face-down tray, it is only necessary to use a normal tab sheet bundle.

10        This did not raise any problems insofar as sheets could be fed only from trays that contain sheets to be conveyed to the image transfer position without being inverted or made upside down. With the progress of the sheet conveying technique, however, it has become  
15        technically possible to convey any type of material, and tab sheets can be also conveyed even from front-loading trays from which sheets are fed to be inverted during conveyance, causing the page order of the tab sheets to be reversed. Therefore, when users want to  
20        print on tab sheets, it is necessary to set a suitable type of tab sheets in a feed tray, after considering whether the sheets are inverted in the conveying path from the feed tray to the image transfer position, or in the conveying path from the image transfer position  
25        to a discharge tray. This increases the operating burden on the users, and there is a fear of producing a heap of misprints, before tab sheets are discharged as

desired, which raises a problem in operating the conventional image forming apparatuses.

#### SUMMARY OF THE INVENTION

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It is an object of the present invention to provide an image forming apparatus which is capable of setting up a tab sheet mode-operating and configuring environment in which an effective tab sheet mode output can be obtained by a simple operation of selecting feeding of tab sheets and a destination of discharge of the tab sheets, without the user being conscious of manners of output of the tab sheet bundle dependent on tab sheet setting, thereby limiting wasteful image formation due to errors in a tab sheet mode process as occurring in the prior art, to save paper resources.

To attain the above object, in a first aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a predetermined tab sheet bundle, comprising a first sheet feed device that feeds each of the tab sheets of the predetermined tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the predetermined tab sheet bundle to the image transfer position via a second conveying path without the tab

sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the predetermined tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the predetermined tab sheet bundle in a face-down state, a page order-designating device that designates page order of tab sheets fed from the first sheet feed device and the second sheet feed device, a storage device that stores sheet management information indicating the page order designated for the first sheet feed device and the second sheet feed device by the page order-designating device in correlation with the first sheet feed device and the second sheet feed device, a tab sheet feed-instructing device that instructs feeding of the tab sheets, and a controller responsive to instruction of feeding of the tab sheets by the tab sheet feed-instructing device, for providing control to automatically select the first sheet feed device or the second sheet feed device that can feed tab sheets that enable a valid image transfer result to be obtained, according to a sheet discharge destination selected by a user for the first sheet discharge device or the second sheet discharge device and the page order designated for the first sheet feed device or the second sheet feed device, indicated by the sheet management information.

With the arrangement of the image forming

apparatus according to the first aspect of the present invention, it is possible to set up a tab sheet mode-operating and configuring environment in which an effective tab sheet mode output can be obtained by a simple operation of selecting feeding of tab sheets and a destination of discharge of the tab sheets, without the user being conscious of manners of output of the tab sheet bundle dependent on tab sheet setting, thereby limiting wasteful image formation due to errors in a tab sheet mode process as occurring in the prior art, to save paper resources.

To attain the above object, in a second aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a predetermined tab sheet bundle, comprising a first sheet feed device that feeds each of the tab sheets of the predetermined tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the predetermined tab sheet bundle to the image transfer position via a second conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the predetermined tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the predetermined tab sheet bundle in



a face-down state, a page order-designating device that designates whether type of sheets fed from the first sheet feed device and the second sheet feed device is a type other than a tab sheet or the tab sheet, and  
5 designates page order thereof if the designated type is the tab sheet, a storage device that stores sheet management information indicating the type and page order designated for the first sheet feed device and the second sheet feed device by the page order-  
10 designating device in correlation with the first sheet feed device and the second sheet feed device, a tab sheet feed-instructing device that instructs feeding of the tab sheets, and a controller responsive to instruction of feeding of the tab sheets by the tab  
15 sheet feed-instructing device, for providing control to automatically select the first sheet feed device or the second sheet feed device that can feed tab sheets that enable a valid image transfer result to be obtained, according to a sheet discharge destination selected by  
20 a user for the first sheet discharge device or the second sheet discharge device and the page order designated for the first sheet feed device or the second sheet feed device, indicated by the sheet management information.

25       With the arrangement of the image forming apparatus according to the second aspect of the present invention, it is possible to obtain the same

advantageous effects as provided by the image forming apparatus according to the first aspect of the present invention.

To attain the above object, in a third aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer position via a second conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a sheet discharge device-selecting device that selects the first sheet discharge device or the second sheet discharge device, a managing device that manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to selection of the first sheet discharge device, for providing control to select the

first sheet feed device in which a tab sheet bundle is set in the normal order or the second sheet feed device in which a tab sheet bundle is set in the reverse order.

With the arrangement of the image forming apparatus according to the third aspect of the present invention, it is possible to set up a tab sheet mode-operating and configuring environment in which an effective tab sheet mode output can be obtained by a simple operation of selecting a destination of discharge of the tab sheets, without the user being conscious of manners of output of the tab sheet bundle dependent on tab sheet setting, thereby limiting wasteful image formation due to errors in a tab sheet mode process as occurring in the prior art, to save paper resources.

To attain the above object, in a fourth aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer position via a second conveying path without the tab sheet being inverted, a first sheet discharge device

that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a sheet  
5 discharge device-selecting device that selects the first sheet discharge device or the second sheet discharge device, a managing device that manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first  
10 sheet feed device and the second sheet feed device, and a controller responsive to selection of the second sheet discharge device, for providing control to select the first sheet feed device in which a tab sheet bundle is set in the reverse order or the second sheet feed  
15 device in which a tab sheet bundle is set in the normal order.

With the arrangement of the image forming apparatus according to the fourth aspect of the present invention, it is possible to obtain the same  
20 advantageous effects as provided by the image forming apparatus according to the third aspect of the present invention.

To attain the above object, in a fifth aspect of the present invention, there is provided an image  
25 forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device

that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer position via a second conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a tab sheet feed-instructing device that instructs feeding of the tab sheets, a selection device that selects the first sheet feed device or the second sheet feed device, a managing device that manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to selection of the first sheet feed device in which a tab sheet bundle is set in the normal order, for providing control to select the first sheet discharge device.

With the arrangement of the image forming apparatus according to the third aspect of the present invention, it is possible to set up a tab sheet mode-operating and configuring environment in which an effective tab sheet mode output can be obtained by a

simple operation of selecting a tab sheet feed device in which a predetermined tab sheet bundle is set, without the user being conscious of manners of output of the tab sheet bundle dependent on tab sheet setting, thereby limiting wasteful image formation due to errors in a tab sheet mode process as occurring in the prior art, to save paper resources.

To attain the above object, in a sixth aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer position via a second conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a tab sheet feed-instructing device that instructs feeding of the tab sheets, a selection device that selects the first sheet feed device or the second sheet feed device, a managing device that manages information as to whether

a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to selection of the first sheet feed device in which a  
5 tab sheet bundle is set in the reverse order, for providing control to select the second sheet discharge device.

With the arrangement of the image forming apparatus according to the sixth aspect of the present  
10 invention, it is possible to obtain the same advantageous effects as provided by the image forming apparatus according to the fifth aspect of the present invention.

To attain the above object, in a seventh aspect of  
15 the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device that feeds each of the tab sheets of the tab sheet  
20 bundle to an image transfer position via a first conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer position via a second conveying path without the tab  
25 sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge

device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a selection device that selects the first sheet feed device or the second sheet feed device, a managing device that  
5 manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to selection of the second sheet feed device in which a tab sheet bundle is  
10 set in the normal order, for providing control to select the second sheet discharge device.

With the arrangement of the image forming apparatus according to the seventh aspect of the present invention, it is possible to obtain the same  
15 advantageous effects as provided by the image forming apparatus according to the fifth aspect of the present invention.

To attain the above object, in an eighth aspect of the present invention, there is provided an image  
20 forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a first sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a first  
25 conveying path with the tab sheet being inverted, a second sheet feed device that feeds each of the tab sheets of the tab sheet bundle to the image transfer



position via a second conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge  
5 device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a selection device that selects the first sheet feed device or the second sheet feed device, a managing device that manages information as to whether a tab sheet bundle is  
10 set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to selection of the second sheet feed device in which a tab sheet bundle is set in the reverse order, for providing control to  
15 select the first sheet discharge device.

With the arrangement of the image forming apparatus according to the eighth aspect of the present invention, it is possible to obtain the same advantageous effects as provided by the image forming  
20 apparatus according to the fifth aspect of the present invention.

To attain the above object, in a ninth aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab  
25 sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a sheet feed device that feeds each of the tab sheets of the tab sheet bundle to

an image transfer portion via a conveying path with the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet  
5 discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a managing device that manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the  
10 second sheet feed device, and a controller responsive to a tab sheet bundle being set in the normal order in the sheet feed device, for providing control to cause the first sheet discharge device to discharge each of the tab sheets of the tab sheet bundle set in the sheet  
15 feed device.

With the arrangement of the image forming apparatus according to the ninth aspect of the present invention, it is possible to set up a tab sheet mode-operating and configuring environment in which an  
20 effective tab sheet mode output can be obtained by a simple operation of setting a predetermined tab sheet bundle in a tab sheet feed device and inputting the setting of the predetermined tab sheet bundle in the tab sheet feed device, without the user being conscious  
25 of manners of output of the tab sheet bundle dependent on tab sheet setting, thereby limiting wasteful image formation due to errors in a tab sheet mode process as

occurring in the prior art, to save paper resources.

To attain the above object, in a tenth aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab  
5 sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer portion via a conveying path with the tab sheet being inverted, a first sheet discharge  
10 device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a managing device that manages information as to whether  
15 a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to a tab sheet bundle being set in the reverse order in the sheet feed device, for providing control to cause  
20 the second sheet discharge device to discharge each of the tab sheets of the tab sheet bundle set in the sheet feed device.

With the arrangement of the image forming apparatus according to the tenth aspect of the present  
25 invention, it is possible to obtain the same advantageous effects as provided by the image forming apparatus according to the ninth aspect of the present

invention.

To attain the above object, in a eleventh aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab  
5 sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer position via a conveying path without the tab sheet being inverted, a first sheet discharge  
10 device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a managing device that manages information as to whether  
15 a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to a tab sheet bundle being set in the normal order in the sheet feed device, for providing control to cause  
20 the second sheet discharge device to discharge each of the tab sheets of the tab sheet bundle set in the sheet feed device.

With the arrangement of the image forming apparatus according to the eleventh aspect of the  
25 present invention, it is possible to obtain the same advantageous effects as provided by the image forming apparatus according to the ninth aspect of the present

invention.

To attain the above object, in a twelfth aspect of the present invention, there is provided an image forming apparatus capable of sequentially feeding tab sheets of a tab sheet bundle set in a normal order or a reverse order, comprising a sheet feed device that feeds each of the tab sheets of the tab sheet bundle to an image transfer portion via a conveying path without the tab sheet being inverted, a first sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-up state, a second sheet discharge device that discharges each of the tab sheets of the tab sheet bundle in a face-down state, a managing device that manages information as to whether a tab sheet bundle is set in the normal order or in the reverse order in the first sheet feed device and the second sheet feed device, and a controller responsive to a tab sheet bundle being set in the reverse order in the sheet feed device, for providing control to cause the first sheet discharge device to discharge each of the tab sheets of the tab sheet bundle set in the sheet feed device.

With the arrangement of the image forming apparatus according to the twelfth aspect of the present invention, it is possible to obtain the same advantageous effects as provided by the image forming apparatus according to the ninth aspect of the present

invention.

The above and other objects, features, and advantages of the present invention will become more apparent from the following detailed description taken  
5 in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-sectional view  
10 schematically showing the arrangement of an image forming apparatus according to an embodiment of the present invention;

FIG. 2 is a plan view showing the layout of an operating section of the image forming apparatus shown  
15 in FIG. 1;

FIGS. 3A and 3B are views showing types of tab sheet bundles applicable to the image forming apparatus, in which FIG. 3A shows a normal tab sheet bundle, and FIG. 3B shows a reverse tab sheet bundle;

20 FIGS. 4A and 4B are views useful in explaining changes in the page order of a tab sheet bundle in a case where the tab sheets of a normal tab sheet bundle are conveyed through the image forming apparatus shown in FIG. 1 from a cassette to a face-up tray, in which  
25 FIG. 4A shows a conveying path via which the tab sheets are conveyed, and FIG. 4B shows a state of the tab sheets stacked in the cassette and a state of the same

stacked in the face-up tray;

FIGS. 5A and 5B are views useful in explaining changes in the page order of a tab sheet bundle in a case where the tab sheets of a reverse tab sheet bundle are conveyed through the image forming apparatus shown in FIG. 1 from the cassette to a face-down tray, in which FIG. 5A shows a conveying path via which the tab sheets are conveyed, and FIG. 5B shows a state of the tab sheets stacked in the cassette and a state of the same stacked in the face-down tray;

FIGS. 6A and 6B are views useful in explaining changes in the page order of a tab sheet bundle in a case where the tab sheets of a reverse tab sheet bundle are conveyed through the image forming apparatus shown in FIG. 1 from a deck to the face-up tray, in which FIG. 6A shows a conveying path via which the tab sheets are conveyed, and FIG. 6B shows a state of the tab sheets stacked in the deck and a state of the same stacked in the face-up tray;

FIGS. 7A and 7B are views useful in explaining changes in the page order of a tab sheet bundle in a case where the tab sheets of a normal tab sheet bundle are conveyed through the image forming apparatus shown in FIG. 1 from the deck to the face-down tray, in which FIG. 7A shows a conveying path via which the tab sheets are conveyed, and FIG. 7B shows a state of the tab sheets stacked in the deck and a state of the same

stacked in the face-down tray;

FIG. 8 is a diagram of a table showing proper combinations of feed tray type, discharge tray type, page output order, and tab sheet type, which enable the  
5 image forming apparatus to output tab sheets in a normal page order;

FIG. 9 is a view of a table showing an example of sheet management information stored in a RAM of a controller section appearing in FIG. 1;

10 FIG. 10 is a flowchart showing a tab sheet mode process executed by the image forming apparatus shown in FIG. 1;

FIGS. 11A and 11B are views showing operating screens displayed on a display panel appearing in FIG.  
15 2, in which FIG. 11A shows an operating screen in a standby state of the image forming apparatus, and FIG. 11B shows an operating screen for selecting a discharge tray;

FIG. 12 is a diagram showing an operating screen  
20 displayed on the display panel shown in FIG. 2;

FIG. 13 is a diagram showing an operating screen displayed on the display panel appearing in FIG. 2;

FIG. 14 is a diagram showing an operating screen displayed on the display panel appearing in FIG. 2;

25 FIG. 15 is a diagram showing an operating screen displayed on the display panel appearing in FIG. 2;

FIG. 16 is a diagram showing an operating screen



displayed on the display panel appearing in FIG. 2; and

FIG. 17 is a diagram useful in explaining the structure of a memory map of a storage medium that stores various data processing programs which can be  
5 read out by the image forming apparatus shown in FIG. 1.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described in  
10 detail with reference to the accompanying drawings showing a preferred embodiment thereof.

FIG. 1 is a longitudinal cross-sectional view schematically showing the arrangement of an image forming apparatus according to an embodiment of the  
15 present invention. The image forming apparatus according to the present embodiment is a 4-drum tandem color image-forming apparatus based on an electrophotographic method, which is capable of selectively using a multi-tray, 4-stage sheet feed  
20 cassettes, or a paper deck (also simply referred to as "the deck"), as a feed tray for feeding sheets.

In FIG. 1, reference numeral 1 designates the image forming apparatus. The image forming apparatus is broadly divided into an image forming section  
25 (comprised of four stations Sa, Sb, Sc, Sd which are juxtaposed and identical in construction), feed trays, an intermediate transfer section, a conveyor section, a

fixing unit, an operating section, and a control unit (controller section, referred to hereinafter). Symbol CONT designates the controller section which is comprised of a controller board provided with a CPU, a RAM, a ROM, and so forth. The controller section CONT performs centralized control of the feed trays, the intermediate transfer section, the conveyor section, the fixing unit, and the operating section, based on control programs stored in the ROM. Further, the ROM stores a program for executing a process described in detail hereinafter with reference to FIG. 10.

Next, the individual units or aforementioned components of the image forming apparatus will be described in detail.

The image forming section is constructed as follows: Photosensitive drums 11a, 11b, 11c, 11d as image carriers are each rotatably supported on a central shaft and driven by a driving motor, not shown, for rotation in a direction indicated by an arrow. Roller chargers 12a, 12b, 12c, 12d, scanners 13a, 13b, 13c, 13d, and developing devices 14a, 14b, 14c, 14d are arranged in the direction of rotation of the photosensitive drums 11a, 11b, 11c, 11d in opposed relation to the peripheral surfaces of the photosensitive drums 11a, 11b, 11c, 11d, respectively. The roller chargers 12a to 12d uniformly electrify or charges the surfaces of the photosensitive drums 11a to

11d by the same amount of electrostatic charge.

The photosensitive drums 11a to 11d are exposed to light beams, such as laser beams, modulated according to recorded image signals by the respective associated  
5 scanners 13a to 13d, whereby electrostatic latent images are formed on the photosensitive drums 11a to 11d, respectively. Further, the electrostatic latent images are developed into visible images by the developing devices 14a to 14d containing developers  
10 (toners) of four colors, i.e. yellow, cyan, magenta and black, respectively, and then the obtained visible images are transferred onto an intermediate transfer belt 30. Thus, by the above described process, image forming is sequentially carried out by the toners of  
15 different colors.

Each feed tray is comprised of a part for receiving sheets P, a roller for conveying a sheet P, a sensor for detecting passage of a sheet P, a sensor for detecting the presence or absence of sheets P, and a  
20 guide (not shown) for guiding a sheet P via a conveying path.

Reference numerals 21a, 21b, 21c, 21d designate cassettes, reference numeral 27 a multi manual feed tray, and reference numeral 28 a deck. These feed  
25 trays hold sheets P. Reference numerals 22a, 22b, 22c, 22d designate pickup rollers for feeding sheets P one by one from the top of a stack of the sheets P from the

associated cassettes 21a to 21d. The cassettes 21a, 21b, 21c, 21d are of the front loading type.

Although the pickup rollers 22a to 22d sometimes feed a plurality of sheets P together, in such a case, only the uppermost one is positively separated by the associated one of BC roller pairs 23a, 23b, 23c, 23d. The sheet P separated by the associated one of the BC roller pairs 23a to 23d is further conveyed by the associated one of pull-off roller pairs 24a to 24d and a pre-registration roller pair 26 to a registration roller pair 25. As is apparent from FIG. 1, sheets set in the cassettes 21a, 21b, 21c, 21d are conveyed to the registration roller pair 25 via respective U-shaped conveying paths. Therefore, an image is transferred onto the lower surface of each sheet, i.e. a surface thereof which faces downward when the sheet is in the cassette 21a, 21b, 21c, or 21d.

Sheets P received in the manual feed tray 27 are fed such that only the uppermost one of the sheets P is separated by a BC roller 29 and conveyed by the pre-registration roller pair 26 to the registration roller pair 25. Further, sheets P received in the deck 28 are fed such that more than one sheet are conveyed by a pickup roller 60 to a sheet feed roller 61, and then only the uppermost one of them is positively separated by the sheet feed roller 61, followed by being carried to a pull-off roller pair 62. Further, the sheet P is

conveyed by the pre-registration roller pair 26 to the registration roller pair 25. In the case of sheets fed from a manual feed tray 27 or the deck 28, an image is transferred onto the upper surface of each sheet, i.e. a surface thereof which faces upward when the sheet is in the manual feed tray 27 or the deck 28.

Next, the intermediate transfer section will be described in detail.

The intermediate transfer belt 30 is formed e.g. of PET (polyethylene terephthalate) or PVdF (polyvinylidene fluoride). Reference numeral 32 designates a driving roller for transmitting a driving force to the intermediate transfer belt 30. The intermediate transfer belt 30 is supported by the driving roller 32, a tension roller 33 for giving an adequate tension to the intermediate transfer belt 30 by the urging force of a spring (not shown), and a driven roller 34 cooperating with a secondary transfer roller 36, referred to hereinafter, to sandwich the intermediate transfer belt 30 therebetween, thereby forming a secondary transfer region.

The driving roller 32 is formed by a metal roller coated with rubber (urethane or chloroprene) of a thickness of several millimeters, so as to prevent slippage of the driving roller 32 on the intermediate transfer belt 30. The driving roller 32 is driven for rotation by a stepper motor (not shown). Primary

transfer rollers 35a to 35d are arranged at respective locations in opposed relation to the associated photosensitive drums 11a to 11d via the intermediate transfer belt 30 interposed therebetween, and have a high voltage applied thereto for transferring toner images from the associated photosensitive drums 11a to 11d onto the intermediate transfer belt 30. The secondary transfer roller 36 is disposed in opposed relation to the driven roller 34, and the secondary transfer region is formed by a nip between the intermediate transfer belt 30 and the two rollers. The secondary transfer roller 36 is pressed against the intermediate transfer belt 30 by an adequate pressure.

At a location downstream of the secondary transfer region on the intermediate transfer belt 30, there is disposed a cleaning device 50 for cleaning an image-forming surface of the intermediate transfer belt 30. The cleaning device 50 is comprised of a cleaner blade 51 (formed e.g. of polyurethane rubber) and a waste toner box 52 for receiving waste toners.

The fixing unit 40 is comprised of a fixing roller 41a containing a heat source, such as a halogen heater, a roller 41b (which can also contain a heat source) pressed against the roller 41a, and an inner sheet discharge roller 44 for conveying a sheet P discharged from the roller pair 41a, 41b.

A sheet P conveyed to the registration roller pair

25 is temporarily stopped by stopping rotations of the rollers upstream of the registration roller pair 25, and then these rollers including the registration roller pair 25 are driven again for restarting rotation  
5 in synchronism with an image forming operation by the image forming section. As a result, the sheet P is sent to the secondary transfer region, described in detail hereinafter.

The sheet P has an image transferred thereon in  
10 the secondary transfer region and fixed by the fixing unit 40, and then passes the inner sheet discharge roller 44. Thereafter, the sheet conveyance direction is switched by a switching flapper 73. When the switching flapper 73 has been switched to a face-up  
15 discharge side, the sheet P is discharged onto a face-up discharge tray (hereinafter referred to as "the face-up tray) 2 by an outer sheet discharge roller pair 45.

On the other hand, when the switching flapper 73  
20 has been switched to a face-down discharge side, the sheet P is conveyed toward inverting roller pairs 72a, 72b, 72c and discharged onto a face-down discharge tray (hereinafter referred to as "the face-down tray) 3.

On the conveying paths of sheets P, there are  
25 arranged a plurality of sensors for detecting passage of a sheet P. The sensors include sheet feed retry sensors 64a, 64b, 64c, 64d, a deck sheet feed sensor 65,

a deck pull-off sensor 66, a registration sensor 67, an inner sheet discharge sensor 68, a face-down sheet discharge sensor 69, a double-sided pre-registration sensor 70, and a double-sided sheet re-feed sensor 71.

5       The cassettes 21a to 21d for containing sheets P are provided with respective cassette sheet presence/absence sensors 63a, 63b, 63c, 63d for detecting the presence or absence of sheets P, and the manual feed tray 27 is provided with a manual feed tray  
10 sheet presence/absence sensor 74 for detecting the presence or absence of sheets P on the manual feed tray 27. Further, the deck 28 is provided with a deck sheet presence/absence sensor 75 for detecting the presence or absence of sheets P in the deck 28.

15       The control unit includes the controller board (not shown) for controlling operations of mechanisms within the above described units, and a motor drive board (not shown).

20       The operating section 4 is disposed in the top of the image forming apparatus 1, and make it possible to select a desired one of the feed trays (the sheet feed cassettes 21a to 21d, the manual feed tray 27, and the deck 28) containing sheets (transfer material), select a desired one of the sheet discharge trays (the face-up  
25 tray 2, and the face-down tray 3), and designate the type of a tab sheet bundle.

Next, a description will be given of the operation



of the image forming apparatus 1. In the following, how sheets P are conveyed from the cassette 21a will be described as an example of the operation of the image forming apparatus 1.

5           When a predetermined time period has elapsed after generation of an image forming operation start signal, first, sheets P are sent out one by one from the cassette 21a. Then, each sheet P is fed by the sheet feed roller pair 23a and conveyed to the registration  
10 roller pair 25 via the pull-off roller pair 24a and the pre-registration roller pair 26. During this operation, the registration roller pair 25 is in stoppage, and hence the leading end of the sheet P abuts on a nip portion of the registration roller pair 25.

15           Thereafter, the registration roller pair 25 starts rotation in timing synchronous with the start of image formation by the image forming section. This start of rotation of the registration roller pair 25 is timed such that the sheet P and a toner image primarily  
20 transferred onto the intermediate transfer belt 30 by the image forming section meet in the secondary transfer region, in proper alignment.

          On the other hand, in the image forming section, when the image forming operation start signal is  
25 generated, a toner image formed on the photosensitive drum 11d upstreammost in the direction of rotation of the intermediate transfer belt 30 is primarily

transferred by the process described hereinabove onto the intermediate transfer belt 30 in a primary transfer region by the transfer roller 35d having a high voltage applied thereto. The primarily transferred toner image  
5 is conveyed to the next primary transfer region (i.e. primary transfer region formed by the photosensitive drum 11c and the transfer roller 35c).

In each primary transfer region, image formation is performed with a time delay corresponding to a time  
10 period for conveying the toner image from one station to another station, and a second toner image is transferred over the first toner image, with the leading end of the second toner image being aligned with that of the first toner image. In each of the  
15 following primary transfer regions, similar processing is carried out, and as a result, a toner image of four colors is primarily transferred onto the intermediate transfer belt 30.

Then, when the sheet P enters the second transfer  
20 region and comes into contact with the intermediate transfer belt 30, a high voltage is applied to the secondary transfer roller 36 in timing synchronous with the passage of the sheet P, whereby the four-color toner image formed on the intermediate transfer belt 30  
25 by the above described process is transferred onto the surface of the sheet P. Thereafter, the sheet P is guided to the nip portion of the fixing roller 41a.

The toner image is fixed on the sheet surface by the heat of the roller pair 41a, 41b and the pressure of the nip. Then, the sheet P is discharged onto the face-up tray 2 or the face-down tray 3 according to a direction selected by the switching flapper 73.

It should be noted that an original reader, not shown, for reading an image of an original and converting the same into image data is connected to the image forming apparatus 1.

Next, the operating section 4 appearing in FIG. 1 will be described with reference to FIG. 2.

FIG. 2 is a plan view showing the layout of the operating section 4 of the image forming apparatus shown in FIG. 1.

In FIG. 2, reference numeral 621 designates a power lamp for indicating that the power is on. Reference numeral 613 designates a power switch. The power lamp 621 is lighted or extinguished in accordance with switching between the power ON and the power OFF by the power switch 613. Reference numeral 622 designates a ten-key pad for use in setting the number of sheets for image formation and entering numerical values for setting a mode. Further, the ten-key pad 622 is used for entering a telephone number in a facsimile configuration screen.

Reference numeral 623 designates a clear key for clearing settings entered via the ten-key pad 622.

Reference numeral 616 designates a reset key for resetting the number of sheets on which an image is to be formed, an operation mode, a selected feed tray, and so forth, set for image formation, to respective  
5 default values.

Reference numeral 614 designates a start key. An image forming operation is started by depressing the start key 614. The start key 614 has red and green LEDs (not shown) arranged in its center, for indicating  
10 whether or not the image forming operation can be started. When the operation is not permitted, the red LED is lighted, whereas when the same is permitted, the green LED is lighted. Reference numeral 615 designates a stop key for use in stopping a copying operation.

15 Reference numeral 617 designates a guide key. When another key is depressed after depression of the guide key 617, a description of a function that can be set by the depressed key is displayed on a display panel. This guidance display can be canceled by  
20 depressing the guide key 617 again.

Reference numeral 618 designates a user configuration key. By depressing this key, a user can configure settings of the image forming apparatus. Settings that the user is allowed to configure include  
25 a time period before a user's configuration is automatically cleared, and default values of modes, automatically set when the reset key 616 is depressed,

for example. Reference numeral 619 designates an interruption key. By depressing this key during an image forming operation, it is possible to suspend the image forming operation and carry out a copying  
5 operation.

Reference numeral 620 designates the display panel implemented e.g. by a liquid crystal. The contents of the display are changed according to a mode to be set so as to facilitate configuration of details of  
10 settings of the mode. Further, the surface of the display panel 620 is configured to function as a touch sensor. In FIG. 2, an operating screen for a copying operation mode is displayed on the display panel 620.

Within the display panel 620, there are displayed  
15 keys 624 to 631. When a portion displaying each key is touched, depression of the key is sensed whereby the mode is configured. The reference numeral 624 designates a key for setting a double-sided operation mode. For example, the key 624 allows setting of three  
20 kinds of double-sided operation modes, i.e. a "single-to-double mode" for carrying out double-side output based on a single-sided original, a "double-to-double mode" for carrying out double-side output based on a double-sided original, and a "double-to-single mode"  
25 for carrying out two single-side outputs based on a double-sided original.

Reference numeral 625 designates a discharge tray

selection key. By depressing this key, it is possible to select one of the face-up tray and the face-down tray for discharging sheets. Reference numeral 626 designates a key for setting an application mode. When  
5 this key is depressed, a screen for setting an applied function mode, such as a multiple operation mode, a reduced layout mode, a cover mode, or an interleaved sheet mode, is displayed on the display panel, and on the screen, configuration keys for respective applied  
10 function modes are displayed e.g. as shown in FIG. 12, thereby enabling the user to set the application mode.

Reference numeral 627 designates a key for selecting a sheet feed stage. When this key is depressed, a selection screen for selecting one of the  
15 cassettes 21a to 21d, the deck 28, and the manual feed tray 27 as a feed tray is displayed on the display panel 620. Reference numerals 628 to 631 are for setting a copying magnification in a copying operation. The keys in the display panel 620 are not only  
20 displayed in an ordinary way, but also, when setting of a mode corresponding to a displayed key is not allowed, the key is displayed in dotted lines or is shaded, to indicate that the key cannot be operated.

Further, in the illustrated example, details of  
25 the user's configuration of the copying operation mode and the present operating state are displayed in the uppermost area of the screen on the display panel 620.

On the other hand, in the lowermost area of the screen on the display panel 620, there is displayed an operating state of another function mode, referred to hereinafter, in a single line as briefly as possible.

5 In FIG. 2, it is indicated that the function of Copy B is in operation for output to a printer section 2.

In FIG. 2, reference numerals 601 to 612 designate keys and LED indicators for setting up functions for copying operation and system operation. The keys 601,  
10 604, 607, 610 are function-switching keys for switching one function to another. These function-switching keys are formed by a translucent key button, and contain an indicator lamp (not shown), such as an LED. When an operating screen is selected by depressing one of the  
15 function-switching keys, the lamp in the key is lighted. The lamps within the keys are controlled such that only a lamp within a key corresponding to a selected operating screen is lighted, and the others are extinguished.

20 Further, the keys have respective green LEDs 603, 606, 609, 612 provided on the right sides thereof. The LEDs 603, 606, 609, 612 indicate operating states of functions of the associated keys by controlled lighting statuses thereof. For example, the LED 606 of the key  
25 604 for Copy B is extinguished during standby of the function of Copy B, and caused to flash during output operation of the same. Similarly, the LED 609 of the

key 607 for Fax is caused to flash during communicating operation, printing operation, and reading operation of the function of Fax.

Further, the keys have respective red LEDs 602, 605, 608, 611 provided on the left sides thereof. The LEDs 602, 605, 608, 611 indicate abnormal operating states of functions of the associated keys by controlled lighting statuses thereof. For example, the LED 605 of the key 604 for Copy B is caused to flash upon occurrence of an abnormality, such as interruption due to absence of sheets, or a sheet jam. In such a case, by depressing the function-switching key 604 for Copy B to switch the operating section 4 to a screen for Copy B, the operating state of the function of Copy B is displayed on the display panel 620, whereby detailed information of the abnormal state can be checked.

These function-switching keys can be depressed anytime, irrespective of the operating states of the functions, to switch the operating section 4 to a desired screen. In the present embodiment, when switching between the function of Copy A and the function of Copy B is allowed, the keys, such as the stop key 615, the start key 614, and the reset key 616, other than the keys within the display panel 620 are operable for the function selected by the function-switching key 601 or 604.



Next, the types of commercially available tab sheet bundles will be described with reference to FIGS. 3A and 3B.

FIGS. 3A and 3B are views showing types of tab sheet bundles applicable to the image forming apparatus 1. FIG. 3A shows a normal tab sheet bundle, while FIG. 3B shows a reverse tab sheet bundle. In the following, a 5-tab sheet bundle having five tabs on a bundle of five sheets, will be described as an example of the commercially available tab sheet bundle.

As shown in FIGS. 3A and 3B, one 5-tab sheet bundle is composed of five sheets. Normally, a tab sheet bundle, of which the uppermost sheet UPF has a tab NTAB at an uppermost right-side portion thereof, as shown in FIG. 3A, (i.e. a tab sheet bundle whose sheets are arranged in normal page order) is called a normal tab sheet bundle, and a tab sheet bundle, of which the lowermost sheet DWF has a tab RTAB at right-side portion thereof, as shown in FIG. 3B, (i.e. a tab sheet bundle whose sheets are arranged in reverse page order) is called a reverse tab sheet bundle. The commercially available tab sheet bundles are mainly of these two types. The first page of the normal tab sheet bundle has a tab at an uppermost location of a right-hand side thereof, and the following pages each have a tab formed at a lower location than the location of a tab on the immediately preceding page. On the other hand, the

last page of the reverse tab sheet bundle has a tab at an uppermost location of a right-hand side thereof, and the preceding pages each have a tab formed at a lower location than the location of a tab on the immediately  
5 following page.

FIGS. 4A to 7B are views useful in explaining changes in the page order of a tab sheet bundle in a case where the tab sheets of the tab sheet bundle are conveyed in the image forming apparatus 1. The same  
10 component parts and elements as appear in FIGS. 1, 3A, and 3B are designated by the same reference numerals. Circled numbers 1 to 5 in FIGS. 4B, 5B, 6B, and 7B designate positions in a conveyance sequence (conveyance sequence numbers) assigned to respective  
15 tab sheets.

Next, changes in the page order of a tab sheet bundle in a case where the tab sheets thereof are conveyed from the cassette 21a to the face-up tray 2 will be explained with reference to FIGS. 4A and 4B.

20 In FIG. 4B, reference numeral 401 designates a tab sheet bundle set in the cassette 21a, as viewed from the top of the apparatus, in exploded form. The tab sheet bundle 401 is a normal tab sheet bundle. The sheets of the tab sheet bundle 401 are sequentially fed  
25 in the order of the conveyance sequence numbers, with a side 401A opposite to a side formed with a tab being directed forward, and conveyed via a path R1 in the

image forming apparatus 1.

An image is formed on the lower surface (after inversion during conveyance) of each tab sheet, i.e. a surface thereof facing downward when the tab sheet bundle 401 is in the cassette 21a, and therefore the page order is reversed. However, in the present case, the tab sheet bundle 401 is discharged onto the face-up tray 2, so that the tab sheets thereof are stacked face-up therein, in a page order further reverse to the reversed page order, i.e. the original page order of the tab sheet bundle 401. Therefore, when a normal tab sheet bundle is used as the tab sheet bundle 401, the tab sheet bundle is discharged to the face-up tray 2 such that the sheets thereof are stacked in the normal page order as shown by a tab sheet bundle 402.

Next, changes in the page order of a tab sheet bundle in a case where the tab sheets thereof are conveyed from the cassette 21a to the face-down tray 3 will be explained with reference to FIGS. 5A and 5B.

In FIG. 5B, reference numeral 501 designates a tab sheet bundle set in the cassette 21a, as viewed from the top of the apparatus, in exploded form. The tab sheet bundle 501 is a reverse tab sheet bundle. The sheets of the tab sheet bundle 501 are sequentially fed in the order of the conveyance sequence numbers, with a side 501A opposite to a side formed with a tab being directed forward, and conveyed via a path R2 in the

image forming apparatus 1.

An image is formed on the lower surface of each tab sheet, i.e. a surface thereof facing upward when the tab sheet bundle 501 is in the cassette 21a, and therefore the page order (reverse page order) is reversed. In the present case, however, the tab sheet bundle is discharged onto the face-down tray 3, so that the tab sheets thereof are stacked face-down therein without changing the reversed page order. Therefore, when a reverse tab sheet bundle is used as the tab sheet bundle 501, the tab sheet bundle is discharged to the face-down tray 3 such that the tab sheets thereof are stacked in the normal page order as shown by a tab sheet bundle 502. In other words, assuming that a normal tab sheet bundle is set in the cassette 21a, the tab sheets reversed in page order during image formation are discharged onto the face-down tray 3 without changing the reversed page order, and hence the obtained output of the tab sheet bundle has the reverse page order.

Next, changes in the page order of a tab sheet bundle in a case where the tab sheets thereof are conveyed from the deck 28 to the face-up tray 2 will be described with reference to FIGS. 6A and 6B.

In FIG. 6B, reference numeral 601 designates a tab sheet bundle set in the deck 28, as viewed from the top of the apparatus, in exploded form. The tab sheet

bundle 601 is a reverse tab sheet bundle. The sheets of the tab sheet bundle 601 are fed with a side 601A opposite to a side formed with a tab being directed forward, and conveyed via a path R3 through the image forming apparatus 1.

An image is formed on the upper surface of each tab sheet, i.e. a surface thereof facing upward when the tab sheet bundle 601 is in the deck 28, and hence the page order is not changed. However, the tab sheet bundle is discharged onto the face-up tray 2, so that the tab sheets thereof are stacked face-up therein in an order reverse to the original reverse page order of the reverse tab sheet bundle, i.e. in the normal page order. Therefore, when a reverse tab sheet bundle is used as the tab sheet bundle 601, the tab sheet bundle is discharged onto the face-up tray 2 such that tab sheets thereof are stacked in the normal page order as a tab sheet bundle 602. In other words, assuming that a normal tab sheet bundle is set in the deck 28, the tab sheets are discharged onto the face-up tray 2, reversing the page order of the normal tab sheet bundle, and hence the obtained output of the tab sheet bundle has the reverse page order.

Next, changes in the page order of a tab sheet bundle in a case where the tab sheets thereof are conveyed from the deck 28 to the face-down tray 3 will be described with reference to FIGS. 7A and 7B.

In FIG. 7B, reference numeral 701 designates a tab sheet bundle set in the deck 28, as viewed from the top of the apparatus, in exploded form. The tab sheet bundle 701 is a normal tab sheet bundle. The sheets of the tab sheet bundle 701 are fed with a side 701A opposite to a side formed with a tab being directed forward, and conveyed via a path R4 in the image forming apparatus 1.

An image is formed on the upper surface of each tab sheet, i.e. a surface thereof facing upward when the tab sheet bundle 601 is in the deck 28, and therefore the page order is not changed. Further, the tab sheet bundle 701 is discharged onto the face-down tray 3, so that the page order is not changed, either. Therefore, when a normal tab sheet bundle is used as the tab sheet bundle 701, the tab sheet bundle is discharged in the normal page order as shown by a tab sheet bundle 702.

Proper combinations of feed tray type, discharge tray type, page output order, and tab sheet type, which enable the image forming apparatus 1 to output tab sheets in the normal page order, as described above with reference to FIGS. 3A to 7B, can be summarized by a table shown in FIG. 8.

As shown in FIG. 8, when the face-down tray is used as a discharge tray, the page order of tab sheets fed from any of the cassettes 21a to 21d is reversed,

and therefore a reverse tab sheet bundle is set in these cassettes. On the other hand, the page order of tab sheets fed from the deck 28 or the manual feed tray 27 is not reversed, and therefore a normal tab sheet bundle is set in the deck 28 and the manual feed tray 27.

On the other hand, when the face-up tray is used as a discharge tray, the page order of tab sheets fed from the cassettes 21a to 21d is not changed, and therefore a normal tab sheet bundle is set in these cassettes. On the other hand, the page order of tab sheets fed from the deck 28 or the manual feed tray 27 is reversed, and therefore, a reverse tab sheet bundle is set in the deck 28 or the manual feed tray 27.

The proper combinations of feed tray type, discharge tray type, page output order, and tab sheet type, as shown in FIG. 8, which make it possible to obtain valid images, may be stored as a tab sheet mode management table, e.g. in a nonvolatile memory, not shown, such as a hard disk and an EEPROM, provided within the controller section CONT, whereby the CPU in the controller section CONT may automatically select a feed tray according to the tab sheet mode management table. This makes it possible to adapt to a case where a feed tray, a sheet discharge tray, or the like is added as an option, not by changing a program executed by the apparatus, but simply by changing the tab sheet

mode management table, which contributes to marked enhancement in the function extensibility of the apparatus.

Further, although in the present embodiment, the sheets of a tab sheet bundle set in any of the cassettes 21a to 21d, the deck 28, and the manual feed tray 27 are fed sequentially starting with the uppermost sheet, this is not limitative, but the sheets of the tab sheet bundle may be fed sequentially starting with the lowermost sheet, for example. In this case, the proper combinations of feed tray type, discharge tray type, page output order, and tab sheet type, which makes it possible to obtain valid images, is different from those shown in FIG. 8 only in that the page output orders are reversed.

FIG. 9 is a diagram showing an example of sheet management information stored in the RAM of the controller section CONT appearing in FIG. 1. The sheet management information may be stored not only in a volatile memory medium, such as a RAM, but also in a hard disk, an EEPROM, or the like, for example.

FIG. 9 corresponds to a state of the image forming apparatus in which a tab sheet preparation mode or a tab sheet insert mode is set for any of the cassette 21a to 21d, the manual feed tray 27, and the deck 28, as feed trays, and a combination of a material of a recording medium to be fed and a page order is



registered for each of them. Therefore, it goes without saying that the user can set the combination for each feed tray, as desired.

As a result, the RAM stores information as to whether sheets set in the feed trays (the cassettes 21a to 21d, the manual feed tray 27, the deck 28) are tab sheets, and if the sheets on a feed tray are tab sheets, whether the page order of tab sheets is a normal one or a reverse one. More specifically, in the illustrated example, the RAM stores information that sheets of plain paper are set in the cassettes 21a and 21b, a normal tab sheet bundle in the cassette 21c, a reverse tab sheet bundle in the cassette 21d, a normal sheet bundle in the manual feed tray 27, and a normal tab sheet bundle in the deck 28.

FIG. 10 is a flowchart showing a tab sheet mode process executed by the image forming apparatus 1 shown in FIG. 1. The present process is executed by the CPU based on the program stored in the ROM of the controller section CONT appearing in FIG. 1. The following description will be given, assuming that the feed trays have sheets set therein as shown in FIG. 9.

When the present process is started, first, it is determined in a step S901 which of the face-down tray 3 or the face-up tray 2 is selected as a discharge tray. If it is determined that the face-up tray 2 is selected, the process proceeds to a step S902, whereas if it is

determined that the face-down tray 3 is selected, the process proceeds to a step S909.

Then, in the step S902, it is determined by referring to the sheet management information shown in FIG. 9 whether or not a tab sheet bundle is set in at least one of the cassettes 21a to 21d. If it is determined that a tab sheet bundle is set in at least one of the cassettes 21a to 21d, the process proceeds to a step S906, wherein it is determined by referring to the sheet management information in FIG. 9 whether or not the page order is a normal one. If it is determined that page order is a normal one, the process proceeds to a step S907 wherein the cassette having the normal tab sheet bundle set therein is selected, followed by terminating the present process.

On the other hand, if it is determined in the step S902 that no tab sheet bundle is set in the cassettes 21a to 21d, or if it is determined in the step S906 that the page order is not a normal one, the process proceeds to a step S903, wherein it is determined by referring to the sheet management information in FIG. 9 whether or not a tab sheet bundle is set in the manual feed tray 27 or in the deck 28. If it is determined that a tab sheet bundle is set in the manual feed tray 27 or in the deck 28, the process proceeds to a step S904, whereas if it is determined that no tab sheet bundle is set in the manual feed tray 27 or in the deck

28, the process proceeds to a step S908.

In the step S908, since there is no proper combination of the selected discharge tray, a feed tray having a tab sheet bundle set therein, and a page order,  
5 a warning process for notifying the user of the fact is executed, followed by terminating the present process.

On the other hand, if it is determined in the step S904 that the set tab sheet bundle is a reverse tab sheet bundle, a most suitable one of the manual feed  
10 tray 27 and the deck 28 is selected in a step S905, followed by terminating the present process.

If it is determined in the step S904 that the set tab sheet bundle is not a reverse tab sheet bundle, since there is no proper combination of a selected  
15 discharge tray, a feed tray having a tab sheet bundle set therein, and a page order, the warning process is executed in the step S908, followed by terminating the present process.

If it is determined in the step S901 that the  
20 face-down tray 3 is selected, the process proceeds to the step S909, wherein it is determined by referring to the sheet management information shown in FIG. 9 whether or not a tab sheet bundle is set in at least one of the cassettes 21a to 21d. If it is determined  
25 that a tab sheet bundle is set in at least one of the cassettes 21a to 21d, the process proceeds to a step S913, wherein it is determined by referring to the

sheet management information in FIG. 9 whether or not the page order is a reverse one. If it is determined that the page order is a reverse one, the process proceeds to a step S914, wherein the cassette having  
5 the tab sheet bundle set therein is selected, followed by terminating the present process.

On the other hand, if it is determined in the step S909 that no tab sheet bundle is set in the cassettes 21a to 21d, or if it is determined in the step S913  
10 that the page order is not a reverse one, the process proceeds to a step S910, wherein it is determined by referring to the sheet management information in FIG. 9 whether or not a tab sheet bundle is set in the manual feed tray 27 or in the deck 28. If it is determined  
15 that a tab sheet bundle is set in the manual feed tray 27 or in the deck 28, the process proceeds to a step S911, whereas if it is determined that no tab sheet bundle is set in the manual feed tray 27 or in the deck 28, the process proceeds to a step S915.

20 Then, it is determined in the step S911 whether or not the tab sheet bundle set in the manual feed tray 27 or in the deck 28 is a normal tab sheet bundle, and if it is determined that the set tab sheet bundle is a normal tab sheet bundle, a most suitable one of the  
25 manual feed tray 27 and the deck 28 is selected in a step S912, followed by terminating the present process.

On the other hand, if it is determined in the step

S911 that the set tab sheet bundle is not a normal tab sheet bundle, since there is no proper combination of a selected discharge tray, a feed tray having a tab sheet bundle set therein, and a page order, the process  
5 proceeds to the step S915, wherein a warning process is executed, followed by terminating the present process.

According to the present process, when the user selects the face-up tray 2 and tab sheet bundles are set as shown in FIG. 9, for example, the normal tab  
10 sheet bundle set in the cassette 21c, which makes a proper combination with the face-up tray 2, is automatically selected.

Although in the above described tab sheet mode process, the sheet management information in FIG. 9 is  
15 stored in the RAM of the controller section CONT, this is not limitative, but the proper combinations of feed tray type, discharge tray type, and the page order of table sheet bundle, which make it possible to obtain valid images as shown in FIG. 8, may be stored as a tab  
20 sheet mode management table in a nonvolatile memory, not shown, such as the hard disk or the EEPROM, provided within the controller section CONT, and the CPU in the controller section CONT may automatically select a feed tray according to the tab sheet mode  
25 management table.

FIGS. 11A and 11B are views showing operating screens displayed on the display panel 620 in FIG. 2.

FIG. 11A shows an operating screen in a standby state, while FIG. 11B shows an operating screen for selecting a discharge tray. In the following, a description will be given of a method of selecting a discharge tray,  
5 according to the present embodiment.

FIG. 11A shows a screen (default or home screen) displayed on the display panel 620 of the operating section 4 in a copying-ready state (standby state) of the image forming apparatus 1. When the discharge tray  
10 selection key 625 is depressed in this screen, the apparatus 1 is switched to a discharge tray selectable state in which a discharge tray selection screen 1002 shown in FIG. 11B is displayed.

Further, when the discharge tray selection screen  
15 1002 is displayed, if a face-up tray key 1001 appearing therein is depressed, sheets fed after the start of the operation of the apparatus 1 are discharged onto the face-up tray 2.

On the other hand, when the discharge tray  
20 selection screen 1002 is displayed, if a face-down tray key 1003 appearing therein is depressed, sheets fed after the start of the operation of the apparatus 1 are discharged onto the face-down tray 3.

Next, a method of designating a page order of a  
25 tab sheet bundle according to the present embodiment, will be described with reference to FIGS. 12 to 16.

FIGS. 12 to 16 are diagrams showing operating

screens displayed on the display panel 620 shown in FIG. 2.

An application mode list screen shown in FIG. 12 is displayed when the application mode key 626 on the display panel 620 shown in FIG. 2 in the standby state is depressed by the user. In the application mode list screen, there are displayed icons for setting respective copy modes.

In FIG. 12, a "duplex-to-duplex copy" key 1221 is for setting a mode in which an original is spread in two pages, and the two pages of original are read as two originals.

A "cover/interleaf" key 1222 is for setting a mode in which a cover sheet, a back cover sheet, or an interleaved sheet for separation of sheets is selected as a sheet to be output, set in a feed tray, and then sheets with the cover sheet, back sheet or interleaved sheet are output as one copy.

A "bookbinding mode" key 1223 is for setting a mode in which after originals have been copied on sheets to be output, the sheets to be output are folded at a center thereof and output like a double-page spread of a book.

A "negative/positive reversal" key 1224 is for setting a mode in which a white portion of an image of an original is copied in black, and a black portion in white.

A "mode memory" key 1225 is for storing a combination of modes set by operating a plurality of keys.

5 An "OHP insert" key 1226 is for setting an OHP insertion mode in which OHP sheets are set e.g. in the manual feed tray 27, and while alternately feeding the OHP sheets set in the manual feed tray 27 and plain sheets, printing is performed on the OHP sheets.

10 An "image composition" key 1228 is for setting a mode in which a background image registered in advance is output with an image for printing being superimposed thereon.

A "tab sheet insert" key 1229 is for setting a mode for inserting a tab sheet as a separation sheet  
15 between print sheets.

A "tab sheet preparation" key 1230 is for setting a mode for feeding a tab sheet and printing on a tab of the tab sheet.

20 A "call" key 1231 is for executing a mode for calling settings made in the immediately preceding copying operation.

A "shift" key 1232 is for setting a mode for shifting the position of an image of an original on a sheet to which the original image is to be output.

25 A "binding margin" key 1233 is for setting a mode for shifting the position of an image of an original on a sheet to which the image is to be output, so as to



form a binding margin.

A "frame erase" key 1234 is for setting a mode for erasing an outer frame of an image of an original, or erasing an image of an outer frame on a sheet before  
5 printing.

A "reduced layout" key 1235 is for setting a mode for laying out images of a plurality of originals in a single sheet on a reduced scale and printing them on a sheet.

10 An "enlarged layout" key 1236 is for setting a mode for splitting an original image of one page into a plurality of images, and printing the split images on an enlarged scale on separate sheets.

A "close" key 1237 is for closing a sub-window for  
15 setting the application mode and returning the screen to the default screen shown in FIG. 11A.

When the user depresses the tab sheet insert key 1229 or the tab sheet preparation key 1230 on the screen described with reference to FIG. 12, the screen  
20 on the display panel 620 is switched to a tab sheet-setting screen shown in FIG. 13.

On the screen shown in FIG. 13, the user can select any of the cassettes, the manual feed tray, and the deck, as a cassette or a tray having tab sheets set  
25 therein.

In FIG. 13, reference numeral 1211 designates a manual feed key, which is depressed to designate the

manual feed tray 27 as a tray having tab sheets set therein. Reference numeral 1212 designates a cassette 1 key, which is depressed to designate the cassette 21a as a cassette having tab sheets set therein.

5       Reference numeral 1213 designates a cassette 2 key, which is depressed to designate the cassette 21b as a cassette having tab sheets set therein. Reference numeral 1214 designates a cassette 3 key, which is depressed to designate the cassette 21c as a cassette  
10       having tab sheets set therein.

      Reference numeral 1215 designates a cassette 4 key, which is depressed to designate the cassette 21d as a cassette having tab sheets set therein. Reference numeral 1216 designates a deck key, which is depressed  
15       to designate the deck 28 as a tray having tab sheets set therein.

      Reference numeral 1217 designates a close key, which is depressed to interrupt an operation for selecting a tray having tab sheets set therein. When  
20       the user depresses any of the above mentioned keys, the screen on the display panel 620 is switched to a tab count-setting screen shown in FIG. 14.

      In the illustrated example of the present embodiment, it is assumed that the cassette 3 key 1214  
25       is depressed on the screen in FIG. 13.

      In the tab count-setting screen shown in FIG. 14, the user enters a tab division number for a tab sheet

bundle. Although a 5-tab sheet bundle formed of a set of five tab sheets is generally used, the tab division number can be set for tab sheet bundles ranging from a 2-tab sheet bundle formed of a set of two tab sheets to  
5 a 12-tab sheet bundle formed of a set of twelve tab sheets. The term "tab division number" means the number of tab sheets forming one set.

In FIG. 14, 1301 designates a field in which the tab division number is being entered to be set. The  
10 tab division number can be increased and decreased by using a "plus" key 1303 and a "minus" key 1302.

An "OK" key 1304 is for setting an entered tab division number. A "cancel" key 1305 is for returning to the application mode screen described with reference  
15 to FIG. 12 from the sub-window for entering the tab division number (the tab count-setting screen shown in FIG. 14), without setting the tab division number.

When the number of tabs is entered on the screen shown in FIG. 14, and thereafter, the OK key 1304 is  
20 depressed, a screen shown in FIG. 15 for designating the page order of a tab sheet bundle is displayed on the display panel 620.

In the screen shown in FIG. 15, the page order of a tab sheet bundle to be set is designated.

25 In FIG. 15, when the tab sheet bundle to be set is a normal tab sheet bundle, a normal tab key 1218 is depressed, while when the tab sheet bundle is a reverse

tab sheet bundle, a reverse tab key 1219 is depressed.

When an OK key 1220 is depressed after depression of the normal tab key 1218 or the reverse tab key 1219 according to the page order of the tab sheet bundle to be set, the setting of the tab sheet type is confirmed,  
5 and a screen shown in FIG. 16 is displayed.

On the other hand, when a cancel key 1238 is depressed, the screen is switched to the screen, shown in FIG. 14, for entering the tab division number.

10 A sheet selection screen displayed as shown in FIG. 16 is the same screen as shown in FIG. 13, but, in the illustrated example, as a result of the designation of the cassette 21c as a cassette having tab sheets set therein, the cassette 3 key 1214 is displayed in  
15 reverse video or highlighted, with an indication "tab" added thereto.

Now, if the close key 1217 is depressed, the screen returns to the default screen shown in FIG. 11A. On the other hand, if any of the keys 1211 to 1216 is  
20 depressed, the screen shown in FIG. 16 continues to be displayed, whereby it is possible to continue configuring the setting of a tab sheet bundle for another feed tray.

As described above, when the face-up tray 2 is  
25 selected, the CPU, not shown, of the controller section CONT provides control such that selection is made of one of the cassettes 21a to 21d (for feeding a tab

sheet bundle via a conveying path in which an image is transferred onto a surface of each sheet of the tab sheet bundle which is inverted during conveyance) in which is set a tab sheet bundle in the normal page order, or one of the deck 28 and the manual feed tray 27 (for feeding a tab sheet bundle via a conveying path in which an image is transferred onto a surface of each sheet of the tab sheet bundle which is fed without being inverted) in which is set a tab sheet bundle in the reverse page order.

On the other hand, when the face-down tray 3 is selected, the CPU of the controller section CONT provides control such that selection is made of one of the cassettes 21a to 21d in which is set a tab sheet bundle in the reverse page order, or one of the deck 28 and the manual feed tray 27 in which is set a tab sheet bundle in the normal page order.

Although in the above described embodiment, when tab sheets are to be fed, a feed tray is selected according to selection of a discharge tray by the user, this is not limitative, but a discharge tray may be selected according to selection of a feed tray by the user.

In this case, for example, the image forming apparatus may be configured such that when one of the cassettes 21a to 21d is selected in which is set a tab sheet bundle in the normal page order, the CPU of the

controller section CONT provides control such that the face-up tray 2 is selected.

Also, the image forming apparatus may be configured such that when one of the cassettes 21a to 21d is selected in which is set a tab sheet bundle in the reverse page order, the CPU of the controller section CONT provides control such that the face-down tray 3 is selected.

Further, the image forming apparatus may be configured such that when one of the deck 28 and the manual feed tray 27 is selected in which is set a tab sheet bundle in the normal page order, the CPU of the controller section CONT provides control such that the face-down tray 3 is selected.

Also, the image forming apparatus may be configured such that when one of the deck 28 and the manual feed tray 27 is selected in which is set a tab sheet bundle in the reverse page order is selected, the CPU of the controller section CONT provides control such that the face-up tray 2 is selected.

Further, the image forming apparatus may be configured such that the CPU of the controller section CONT causes tab sheets fed from any of the cassettes 21a to 21d in which is set a tab sheet bundle in the normal page order to be discharged onto the face-up tray 2.

Also, the image forming apparatus may be

configured such that the CPU of the controller section  
CONT causes tab sheets fed from any of the cassettes  
21a to 21d in which is set a tab sheet bundle in the  
reverse page order to be discharged onto the face-down  
5 tray 3.

Further, the image forming apparatus may be  
configured such that the CPU of the controller section  
CONT causes tab sheets fed from one of the deck 28 or  
the manual feed tray 27 in which is set a tab sheet  
10 bundle in the normal page order to be discharged onto  
the face-down tray 3.

Also, the image forming apparatus may be  
configured such that the CPU of the controller section  
CONT causes tab sheets fed from the deck 28 or the  
15 manual feed tray 27 in which is set a tab sheet bundle  
in the reverse page order to be discharged onto the  
face-up tray 2.

Hereafter, a description will be given of a data  
processing program that can be read by the image  
20 forming apparatus according to the present embodiment,  
by referring to a memory map shown in FIG. 17.

FIG. 17 is a diagram useful in explaining the  
structure of a memory map of a storage medium that  
stores various data processing programs which can be  
25 read out by the image forming apparatus shown in FIG. 1.

Although not specifically shown, the storage  
medium sometimes also stores information for managing a

group of control programs stored in the storage medium, such as information of versions of the programs, and creators of the same, and at the same time, information dependent on an OS (operating system) that reads out  
5 the programs, such as icons discriminatively representing the programs.

Further, data subordinate to the programs are also managed in a directory defined by the memory map. Further, in a case where a program for installing  
10 various programs in a computer, or programs to be installed are in a compressed format, a program for expanding the compressed data may also be stored in the memory medium.

The functions of the image forming apparatus  
15 according to the present embodiment described hereinbefore with reference to FIG. 10 may be executed by a host computer, based on a program externally installed on the computer. In this case, the present invention is applicable to a case where a group of  
20 information including the program code is supplied to an input device of the host computer from a storage medium, such as a CD-ROM, a flash memory, and an FD, or from an internal storage medium via a network. More specifically, a printer driver installed on the host  
25 computer may provide the control described hereinabove according to the flowchart shown in FIG. 10.

It is to be understood that the object of the



present invention may also be accomplished by supplying a system or an apparatus with a storage medium in which a program code of software which realizes the functions of the above described embodiment is stored, and  
5 causing a computer (or CPU or MPU) of the system or apparatus to read out and execute the program code stored in the storage medium.

In this case, the program code itself read from the storage medium realizes the functions of the above  
10 described embodiment, and hence the storage medium on which the program code is stored constitutes the present invention.

Examples of the storage medium for supplying the program code include a floppy (registered trademark)  
15 disk, a hard disk, an optical disk, a magneto-optical disk, a CD-ROM, a CD-R, a CD-RW, a DVD-ROM, a DVD-RAM, a DVD-RW, a DVD+RW, a magnetic tape, a nonvolatile memory card, and a ROM. Further, the program code may be downloaded via a network.

20 Further, it is to be understood that the functions of the above described embodiment may be accomplished not only by executing a program code read out by a computer, but also by causing an OS (operating system) or the like which operates on the computer to perform a  
25 part or all of the actual operations based on instructions of the program code.

Further, it is to be understood that the functions

of the above described embodiment may be accomplished by writing the program code read out from the storage medium into a memory provided in an expansion board inserted into a computer or in an expansion unit

5 connected to the computer and then causing a CPU or the like provided in the expansion board or the expansion unit to perform a part or all of the actual operations based on instructions of the program code.